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(71) Applicant(s)
Koyo Seiko Co., Ltd

(Incorporated in Japan)

5-8 Minamisemba 3-chome, Chuo-ku, Osaka 542, Japan

(72) Inventor(s)
Kenichi Aota
Junya Watanabe

(74) Agent and/or Address for Service
Marks & Clerk
Alpha Tower, Suffolk Street Queensway, BIRMINGHAM, B1 1TT, United Kingdom

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GB 2057632 A GB 2019529 A GB 1405541 A
EP 0392858 A1 US 4551115 A

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(54) Elastic shaft coupling

(57) An elastic shaft coupling comprises a tubular member 12 connected to a hole 6 of a yoke 1 through an elastic member 7 and is provided with a stopper portion 8 to prevent an excessive relative rotation between the yoke 1 and the tubular member 12. The stopper portion 8 is formed by a pair of first parallel surfaces 15a, 15b formed on an internal peripheral surface adjacent the hole 6 of the yoke 1 and a pair of second parallel surfaces 12a, 12b formed on the outer peripheral surface of the tubular member 12 and normally parallel to the first parallel surfaces 15. The tubular member 12 may be replaced by a shaft member (17, Fig 4).

FIG. 1

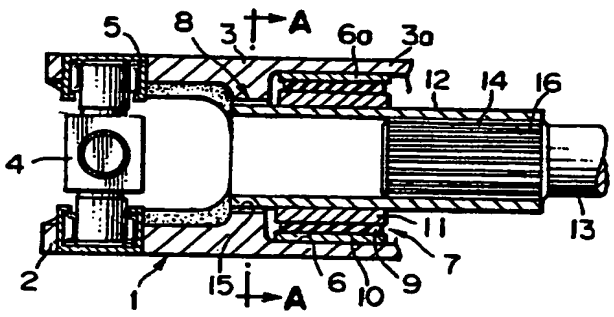

FIG. 2

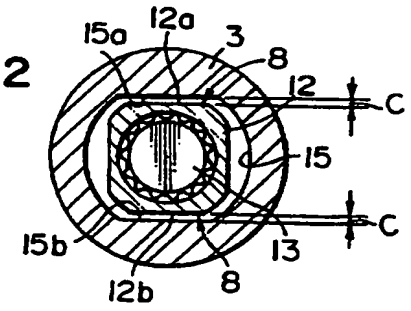

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FIG. 1

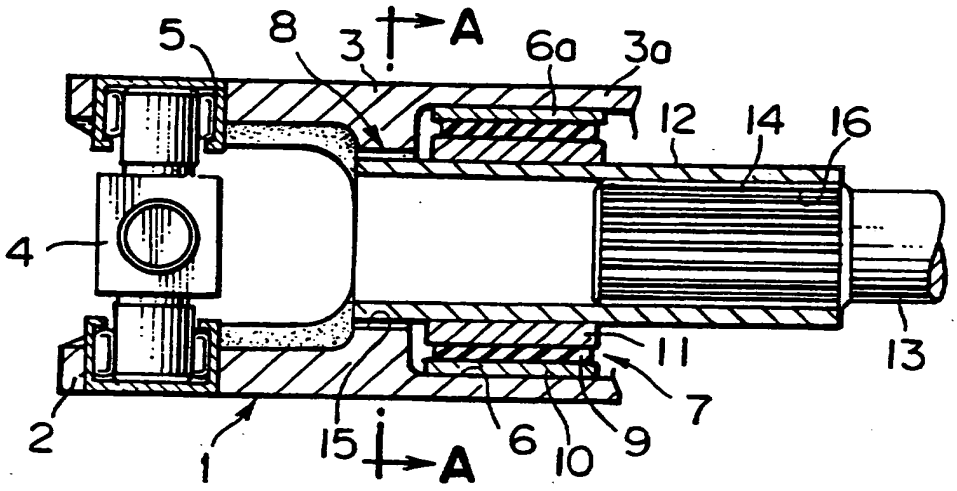


FIG. 2

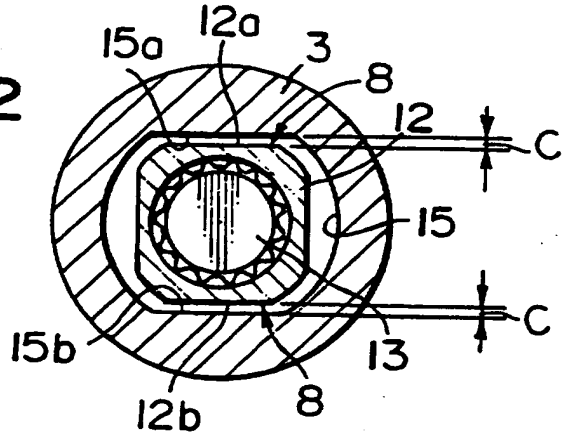


FIG. 3

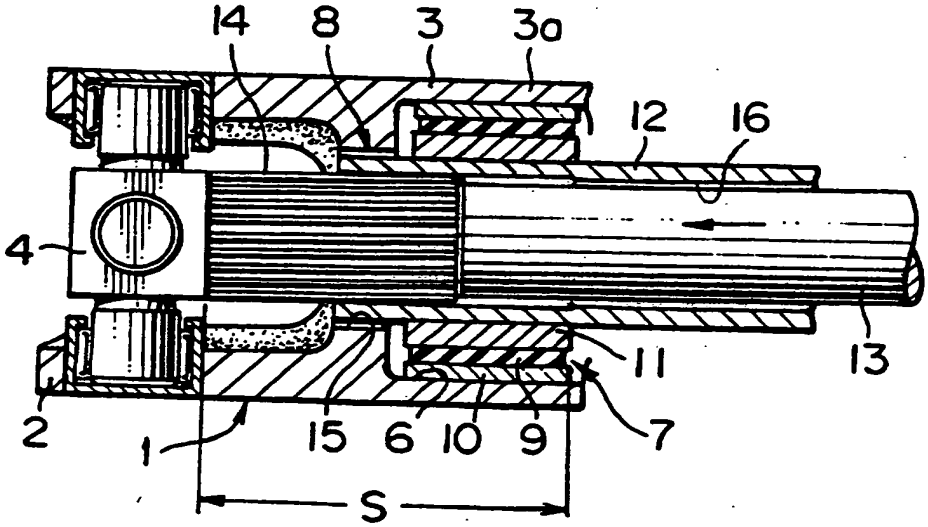


FIG. 4

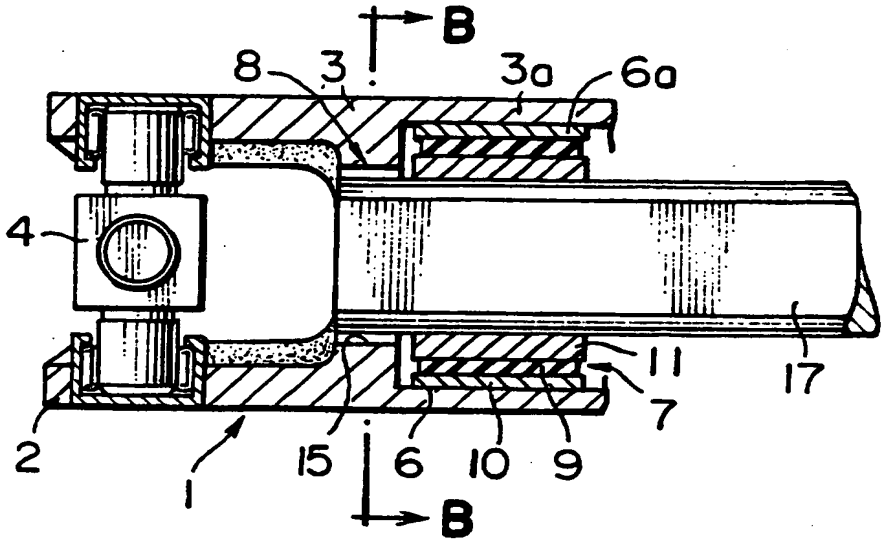
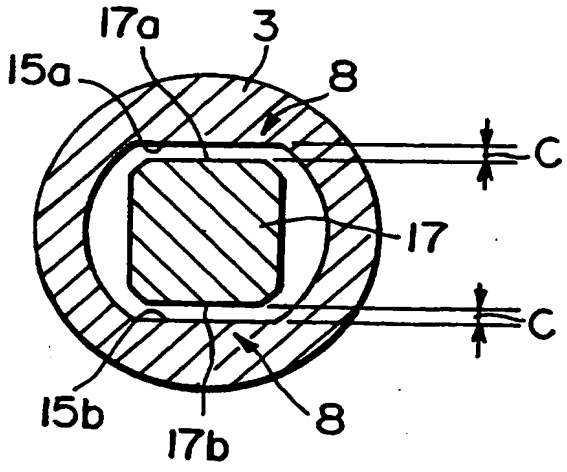


FIG. 5



TITLE OF THE INVENTION

ELASTIC SHAFT COUPLING

FIELD OF THE INVENTION

The present invention relates to an elastic shaft coupling used for a handle joint of an automobile or the like.

DESCRIPTION OF THE RELATED ART

A conventional elastic shaft coupling used for a handle joint of an automobile or the like has been known from Japanese Utility Model Publication No. 7 (1995)-43494 issued on October 9, 1995. This elastic shaft coupling comprises a york having a fitting hole for a cross shaft in an arm portion on one side and an axial fixedly fitting hole in a base portion on the other side; a tubular member having an external peripheral portion fitted in the fixedly fitting hole of the york and in which a shaft member is axially movably fitted in an inner peripheral portion; an elastic member intervened between the fixedly fitting hole of the end of the base portion of the york and the tubular member and secured to the fixedly fitting hole and the tubular member; and a stopper provided between the york and the tubular member to prevent an excessive rotational relative displacement.

In the above elastic shaft coupling, the end of the base portion, the elastic member and the tubular member are formed with diametrically communicating through-holes. A pin member is inserted into the through-hole and secured to the through-hole of the tubular member. A circumferential predetermined clearance is provided between the pin member and the base portion of the york to allow a predetermined rotational relative displacement of the york and the tubular member. The pin member constitutes

a stopper portion for preventing the excessive relative displacement of the york and the tubular member.

The function of the elastic shaft coupling, which is used for a handle joint, will be explained hereinafter.

The elastic member is provided so as not to transmit vibrations of an automobile to a steering wheel. At the time of small torque transmission such as steering during the running of an automobile, the torque transmission between the tubular member and the york is effected by the elastic force of the elastic member. Further, at the time of large torque transmission such as steering during the stopping of an automobile, the elastic member becomes elastically deformed so that the pin member rotates around the diametrically central part into contact with the york, constituting a stopper portion. From this time, engagement between the pin member and the york causes the torque transmission between the tubular member and the york. The function of the elastic shaft coupling has been heretofore well known.

A further conventional elastic shaft coupling has been known from Japanese Utility Model Application Laid-Open No. 5 (1993)-89964 issued on December 7, 1993. This elastic shaft coupling comprises a york having a fitting hole for a cross shaft in an arm portion on one end side and an axial fixedly fitting hole in a base portion on the other end side; a shaft member fitted in the fixedly fitting hole of the york; an elastic member intervened between the fixedly fitting hole of the end of the base portion of the york and the shaft member and secured to the fixedly fitting hole and the shaft member; and a stopper portion provided between the york and the tubular member to prevent an excessive rotational relative displacement of both the members.

In the above elastic shaft coupling, a diametrical notch portion as a stopper portion is formed in a position opposed through 180 degrees of an internal peripheral surface of the

fixedly fitting hole of a connecting portion of the arm portion of the base portion of the york, and a stopper plate in engagement with the notch portion is secured to a shaft end portion. The function of the elastic shaft coupling which is used for example, for a handle joint of an automobile is similar to the aforementioned prior art, explanation of which is therefore omitted.

However, in the former elastic shaft coupling described above, after the elastic member has been pressed in and secured to the york and the tubular member, the diametrical through-hole through which the pin member is inserted is processed. This poses a problem that the elastic member is cut so that the durability is insufficient.

Further, the number of assembling steps is large and the number of parts is many, posing a problem that the cost is high.

Further, in the case where the elastic shaft coupling is used for example, for a handle joint of an automobile, a steering shaft is axially movably fitted in the tubular member. In the case where a shock absorbing mechanism is employed for the steering shaft, when an automobile collides, the steering shaft slidably moves within the york to contract the full length. Therefore, the steering shaft interferes with the pin member, posing a problem in that a large moving stroke of the steering shaft is not taken and a sufficient shock absorbing function is hard to provide.

In the latter elastic shaft coupling, it is designed so that a diametrical notch portion as a stopper portion is formed in a position opposed through 180 degrees of the fixedly fitting hole of the connecting portion of the arm portion of the base portion of the york, posing a problem that the strength of the base portion of the york possibly lowers.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an elastic shaft coupling which is intended to enhance the strength of the coupling and reduce the cost, and which can be used, in the case where for example, it is used as a handle joint of an automobile, irrespective of the presence or absence of a shock absorbing mechanism of a steering shaft connected to an elastic shaft coupling.

According to one embodiment of an elastic shaft coupling of the present invention, there comprises a york having a fitting hole for a cross shaft in an arm portion on one end side and an axially extending-through fixedly fitting hole in a base portion on the other end side; a tubular member in which an external peripheral portion is fitted in the fixedly fitting hole of the york and a shaft member is axially movably fitted in an internal peripheral portion; an elastic member intervened between the fixedly fitting hole of the end of the base portion of the york and the tubular member and secured to the fixedly fitting hole and the tubular member; a pair of first parallel surfaces formed so as to axially extend positions opposed through 180 degrees of an internal peripheral surface of the fixedly fitting hole on the arm portion side of the base of the york; a pair of second parallel surfaces formed so as to axially extend positions opposed through 180 degrees of an outer peripheral surface of the end of the tubular member and to be parallel to said first parallel surfaces; and a stopper portion provided between the york and the tubular member to prevent an excessive rotational relative displacement of both the members, said york and said tubular member being fitted with the first parallel surfaces of the base portion of the york and the second parallel surfaces of the tubular member, said first and second parallel surfaces constituting a stopper portion.

In a further embodiment, in place of the tubular member, a shaft member is directly fitted in the fixedly fitting hole.

In the elastic shaft coupling according to the present invention, since the elastic member and the stopper portion are provided separately in axially parallel positions, it is unnecessary to apply processing to the elastic member. Accordingly, the durability of the elastic member is enhanced. Further, since the pair of parallel surfaces are formed in the internal peripheral surface of the fixedly fitting hole of the base portion of the york to apply them to the stopper portion, a notched groove for a stopper is not particularly formed in the base portion of the york, thus enhancing the strength of the coupling.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view of a first embodiment of an elastic shaft coupling according to the present invention;

FIG. 2 is a sectional view taken on A-A of FIG. 1;

FIG. 3 is an operational view of a first embodiment of an elastic shaft coupling according to the present invention;

FIG. 4 is a sectional view of a second embodiment of an elastic shaft coupling according to the present invention; and

FIG. 5 is a sectional view taken on A-A of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will now be explained by way of embodiments with reference to the drawings.

A first embodiment in which an elastic shaft coupling according to the present invention is used as a handle joint of an automobile will be explained with reference to FIGS. 1 and 2. On one end side of a york 1, a fitting hole 5 for a cross shaft 4 is provided in a fork-like arm portion 2, and an axial fixedly fitting hole 6 is provided in a base portion 3 on the other end

side. A tubular member 12 is fitted in the fixedly fitting hole 6 of the york 1. An elastic member 7 secured to the fixedly fitting hole 6a and the tubular member 12 is intervened between fixedly fitting hole 6a of an end 3a of the base portion of the york 1 and the tubular member 12. In a lateral parallel position with the elastic member 7 and between an inner peripheral surface of a fixedly fitting hole 15 on the side of the arm portion 3 of the york 1 and an outer peripheral surface of the tubular member 12 is provided a stopper portion 8 to prevent an excessive rotational relative displacement of both the members 1 and 12.

The elastic member 7 is formed from a cylindrical rubber damper 9. Metal sleeves 10 and 11 are integrally baked on an external peripheral surface and an internal peripheral surface of the elastic member 7. The internal and external sleeves 10 and 11 are pressed and fitted in the internal peripheral surface of the fixedly fitting hole 6a provided in the end 3a of the base portion of the york 1 and the external peripheral surface of the tubular member 12. It is noted that instead of baking the sleeves 10 and 11 to the elastic member 7, the external peripheral surface and the internal peripheral surface of the rubber damper 9 may be directly baked to the internal peripheral surface of the fixedly fitting hole 6a provided in the end 3a of the base portion of the york 1 and the external peripheral surface of the tubular member 12.

The internal peripheral surface of the tubular member 12 is circular. A spline 16 is formed in an internal peripheral surface of one end on the counter-york side of the tubular member 12 and fitted with a spline 14 of a steering shaft 13 either of the steering side or the handle side. The steering shaft 13 is provided with a shock absorbing mechanism (not shown). A so-called collapse mechanism is provided. The fitting of the steering shaft 13 into the tubular portion 12 is arranged so that the former cane slidably within the tubular member 12. This is

because of the fact that when the automobiles collides, the steering shaft 13 absorbs the shock to contract the full length in an axial direction.

A pair of axially extending parallel surfaces 15a, 15b are formed, in positions opposed through 180 degrees, in the internal peripheral surface of the fixedly fitting hole on the arm portion side provided in the base portion 3 of the york 1, as shown in FIG. 2. The pair of first parallel surfaces are planes (section on A-A) perpendicular to the axis, whose section is substantially elliptic having a pair of parallel sides. The provision of substantially ellipse facilitates the processing of the internal peripheral surface of the fixedly fitting hole 15. Of course, the internal peripheral surface of the fixedly fitting hole on the arm portion side 15 of the base portion 3 of the york 1 will suffice to have the pair of first parallel surfaces 15a, 15b, whose section is not particularly limited to an ellipse.

The tubular member 12 is fitted into the fixedly fitting hole 6 of the york, and a pair of second parallel surfaces 12a, 12b, which axially extend in positions opposed through 180 degrees and parallel to said first parallel surfaces 15a, 15b are formed in the external peripheral surface of the end on the york side of the tubular member. The second parallel surfaces 12a, 12b are formed by processing them into a substantially square in section in a plane (section on A-A) perpendicular to the axis, by way of applying drawing or pressing to the external peripheral surface of the tubular member 12. Of course, it will suffice to form the second parallel surfaces 12a, 12b, whose section need not be limited to a square in section, but a separate member having the pair of second parallel surfaces 12a, 12b may be fitted in and secured to the outer peripheral surface of the end of the tubular member 12.

The first parallel surfaces 15a, 15b formed with the york 1 and the tubular member 12 in the fixedly fitting hole 15 of the

base portion 3 of the york and the second parallel surfaces formed in the end on the york side of the tubular member 12 are opposed and fitted with a predetermined clearance c, and engagement between the first and second parallel surfaces 15a, 15b, and 12a, 12b constitutes the stopper portion 8.

In the elastic shaft coupling according to this embodiment, when a small torque of steering or the like is transmitted during the running of the automobile, a torque is transmitted between the tubular member 12 and the york 1 by the elastic force of the elastic member 7. When a large torque of steering or the like is transmitted during the stopping of the automobile, the elastic member 7 becomes elastically deformed so that the base portion 3 of the york and the tubular member relatively rotate by a predetermined spacing c between the first and second parallel surfaces 15a, 15b and 12a, 12b, and engagement between the first and second parallel surfaces 15a, 15b and 12a, 12b constitutes the stopper portion 8. From this time, the torque is transmitted between the tubular member 12 and the york 1 by the engagement between the tubular member 12 and the york 1

According to the above-described embodiment, since the elastic member 7 and the stopper portion 8 are separated in an axially parallel position, the elastic member is not processed as in prior art, thus enhancing the durability of the elastic member 7. In the case where the steering shaft 13 fitted in the tubular member 12 is provided with a shock absorbing mechanism, i.e., a collapse mechanism, when an automobile collides, as a moving stroke for contracting the full length of the steering shaft 13 in a direction as indicated by arrow, a large stroke amount of the distance S from the first fitting position to the cross shaft 4 is obtained, thus enhancing the shock absorbing performance.

A second embodiment will be explained hereinafter with reference to FIG. 4. The same parts as those described in FIGS.

1 and 2 are indicated by the same reference numerals, explanation of which is omitted.

In place of the tubular member 12 shown in FIGS. 1 and 2, a shaft member 17 is directly fitted in the fixedly fitting hole 6 of the york 1, and the elastic member 7 is intervened between the fixedly fitting hole 6a of the end 3a of the base portion of the york 6 and the shaft member 17. The internal and external surfaces of the elastic member 7 are pressed in and secured to the fixedly fitting hole 6a of the york 1 and the shaft member 17. A pair of axially extending first parallel surfaces 15a, 15b are formed in positions opposed through 180 degrees of the internal peripheral surface of the fixedly fitting hole 15 on the side of the arm portion of the base portion 3 of the york 1. Further, a pair of second parallel surfaces 17a, 17b are formed which axially extend in positions opposed through 180 degrees of the outer peripheral surface of the base portion of the shaft member 17 and are parallel to the first parallel surfaces 15a, 15b. The york 1 and the shaft member 17 are fitted with the first parallel surfaces 15a, 15b of the base portion 3 of the york and the second parallel surfaces 17a, 17b of the shaft member 17 opposed with a predetermined clearance c, and the first and second parallel surfaces 15a, 15b and 17a, 17b constitute a stopper portion.

A pair of first parallel surfaces 15a, 15b extending to positions opposed through 180 degrees are formed in the internal peripheral surface of the fixedly fitting hole 15 on the side of the arm portion of the base portion 3 of the york 1, whose section in a plane (section on B-B) perpendicular to the axis is substantially elliptic having a pair of parallel sides. The provision of the substantially ellipse facilitates the processing of the internal peripheral surface of the fixedly fitting hole 15. However, the internal peripheral surface of the fixedly fitting hole 15 on the side of the arm portion of the base

portion 3 of the york 1 will suffice to have a pair of first parallel surfaces 15a, 15b and is not particularly limited to an ellipse.

Further, the second parallel surfaces 17a, 17b in the end of the shaft member 17 on the side fitted in the york fixedly fitting hole 15 are formed by processing them into a substantially square in section in a plane (section on B-B) perpendicular to the axis. Of course, since the second parallel surfaces 17a, 17b will suffice to be formed, the shape is not limited to a substantially square in section, but a separate member having a pair of second parallel surfaces 17a, 17b may be fitted and secured to the outer peripheral surface of the end of the shaft member 17.

CLAIMS

1. An elastic shaft coupling comprising:

a yoke having a fitting hole for a cross shaft in an arm portion on one end side and an axially extending-through fixedly fitting hole in a base portion on the other end side;

a tubular member in which an external peripheral portion is fitted in the fixedly fitting hole of the yoke and a shaft member is axially movably fitted in an internal peripheral portion;

an elastic member intervened between the fixedly fitting hole of the end of the base portion of the yoke and the tubular member and secured to the fixedly fitting hole and the tubular member;

a pair of first parallel surfaces formed so as to axially extend positions opposed through 180 degrees of an internal peripheral surface of the fixedly fitting hole on the arm portion side of the base of the yoke;

a pair of second parallel surfaces formed so as to axially extend positions opposed through 180 degrees of an outer peripheral surface of the end of the tubular member and to be parallel to said first parallel surfaces; and

a stopper portion provided between the yoke and the tubular member to prevent an excessive rotational relative displacement of both the members, said yoke and said tubular member being fitted with the first parallel surfaces of the base portion of the yoke and the second parallel surfaces of the tubular member, said first and second parallel surfaces constituting a stopper portion.

2. The elastic shaft coupling according to claim 1, wherein the internal peripheral surface of the fixedly

fitting hole on the arm portion side of the base portion of the yoke is substantially elliptic having a pair of first parallel surfaces extending axially in positions opposed through 180 degrees.

3. An elastic shaft coupling comprising:

a yoke having a fitting hole for a cross shaft in an arm portion on one end side and an axially extending-through fixedly fitting hole in a base portion on the other end side;

a shaft member fitted in the fixedly fitting hole of the yoke;

an elastic member intervened between the fixedly fitting hole of the end of the base portion of the yoke and the tubular member and secured to the fixedly fitting hole and the tubular member;

a pair of first parallel surfaces formed so as to axially extend positions opposed through 180 degrees of an internal peripheral surface of the fixedly fitting hole on the arm portion side of the base of the yoke;

a pair of second parallel surfaces formed so as to axially extend positions opposed through 180 degrees of an outer peripheral surface of the end of the tubular member and to be parallel to said first parallel surfaces; and

a stopper portion provided between the yoke and the shaft member to prevent an excessive rotational relative displacement of both the members, said yoke and said shaft member being fitted with the first parallel surfaces of the base portion of the yoke and the second parallel surfaces of the shaft member, said first and second parallel surfaces constituting a stopper portion.

4. The elastic shaft coupling according to claim 3, wherein the internal peripheral surface of the fixedly fitting hole on the arm portion side of the base portion of the yoke is substantially elliptic having a pair of first parallel surfaces extending axially in positions opposed through 180 degrees.

5. An elastic shaft coupling substantially as hereinbefore described, with reference to Figures 1 to 3 or Figures 4 and 5 of the accompanying drawings.

The Patent Office

14

Application No: GB 9716114.5 **Examiner:** C J Duff
Claims searched: 1 - 5 **Date of search:** 7 November 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): F2U

Int Cl (Ed.6): B62D 1/16, 1/18, 1/19; F16D 3/00, 3/02, 3/10, 3/12

Other: On-line: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	GB 2057632 A	(NADELLA) Whole document	
A	GB 2019529 A	(DUNLOP) Whole document	
A	GB 1405541	(PITNER) Whole document	
X	EP 0392858 A1	(NISSAN) Whole document	1 - 4
X	US 4551115	(FERGUSON) Whole document	1, 3

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.